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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/593,254	09/18/2006	Tsuyoshi Takahashi	296428US26PCT	7026

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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER	
MILLER, JR, JOSEPH ALBERT	

ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
08/19/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com
oblonpat@oblon.com
jgardner@oblon.com

Office Action Summary	Application No.	Applicant(s)	
	10/593,254	TAKAHASHI ET AL.	
	Examiner	Art Unit	
	JOSEPH MILLER JR	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 July 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,5,9-15 and 19-21* is/are pending in the application.

4a) Of the above claim(s) *9-15* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 5, 19-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 5, 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rangarajan (Thin Solid Films, 419, 2002, p1-4) as evidenced by Soulet (Optimizing, Materials & Gases, Semiconductor Fabtech – 27th Edition) and Smith (7,070,833) in view of Buchanan (6,984,591), Kopacz (6,368,987) and Metzner (2003/0232506).

Rangarajan teaches a process to deposit hafnium silicate films (abstract). Rangarajan teaches the placing of a substrate in a chamber to form a hafnium silicate film by flowing HTB and a gas of silicon hydride (Section 2, experimental).

Regarding the limitation on heating the substrate, Rangarajan teaches performing the process at 410 degrees Celsius. Though Rangarajan does not teach that this temperature is specifically higher than or equal to the decomposition temperature at which the metal alkoxide decomposes, the decomposition temperature of the precursor is around or above 234 degrees Celsius according to Soulet (p3, last sentence on page), thereby teaching within claimed temperature range. Also, though Rangarajan does not explicitly teach that the temperature is below the decomposition temperature of silicon hydroxide, Smith teaches that the decomposition of silicon hydride gas is from about 300 to about 600 degrees Celsius, thereby teaching within claimed temperature range.

Though Rangarajan does not explicitly teach the result of producing an intermediate of isobutylene, however, since the prior art and the present claims teach all the same process steps, the results of producing an intermediate of isobutylene obtained by applicants process must necessarily be the same as those obtained by the

prior art. It is disclosed in the specification [0043, 0044] that decomposing HTB at temperatures over 350 degrees Celsius produces isolbutylene. Since the prior art teaches the decomposition of HTB at 410 degrees Celsius, it follows that an intermediate of isobutylene must necessarily be produced.

Rangarajan does not explicitly teach introducing the gases through respective passages separated from each other. For the reasons discussed above, the examiner takes the position that the gases must inherently by introduced in separate passages in the process of Rangarajan, however, the Examiner additionally provides the following.

Buchanan teaches deposition of films containing metal and silane where the materials are introduced into the chamber at the same time, but through separate inlets (col 18, line 45- col 19, line 9).

Kopacz teaches an apparatus and method for depositing a film by CVD where the first and second reactants are flowed separately though the showerhead (abstract).

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the introduction of silane and hafnium sources through separate inlets as taught by Buchanan to the hafnium silicate film formation technique of Rangarajan as introducing the silane and hafnium components through separately inlets would allow them to be introduced simultaneously as taught by Buchanan (col 18, line 45- col 19, line 9). It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the use of separate inlets further for the purpose of avoiding premature deposition of the reactants in the system (Kopacz, abstract).

Because Rangarajan teaches the heating of the substrate to a temperature of 410 degree Celsius, it is obvious that this is the desired reaction temperature therefore it would be obvious to apply Rangarajan in view of Buchanan where the temperature that the gas is introduced at is lower than the decomposition temperature of the hafnium precursor so that the reaction can occur (only) on the substrate. Concern with the temperature of the hafnium precursor as Rangarajan teaches maintaining the hafnium precursor with a bubbler temperature of 31 degrees Celsius (experimental), well below the self decomposition temperature.

Rangarajan in view of Buchanan does not teach the use of disilane as the silicon hydride source.

Metzner teaches a process for the formation of a hafnium silicate layer deposited by a CVD method in the temperature range of about 325 to about 700 degrees Celsius [0049-0052]. Metzner teaches that silane or disilane may be used as the silane source [0052].

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the use of disilane as taught by Metzner in the formation of a hafnium silicate layer as an alternative to the silane taught by Rangarajan as one would have a reasonable expectation of success in forming a silicate film with disilane based on Metzner's successful use of disilane to form a hafnium silicate film.

Regarding claims 5 and 21, Rangarajan teaches a temperature in claimed range.

Regarding claim 19, Rangarajan clearly teaches the use of the hafnium silicate film as a gate dielectric (introduction). Buchanan teaches the use of a silicon dioxide

coated substrate for the deposition of a high k layer (col 23, line 58 – col 24, line 55). It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the use of a silicon dioxide coated substrate as taught by Buchanan to the metal silicate layer of Rangarajan as one could apply the silicon dioxide substrate with a reasonable expectation of success in forming a gate stack for a semiconductor application.

In regards to further applying a gate electrode on the gate dielectric, Buchanan further teaches the formation of a transistor including a gate stack which comprises a gate electrode (item 52 in Fig. 4) which has been deposited over a hafnium silicate layer (layer 56) (col 23, line 55 – col 24, line 55). (In alternative, layers 55 and/or 57 may be a metal silicate; with hafnium silicate being taught as a known silicate). It would have been obvious to one of ordinary skill in the art at the time of the invention as the step of adding a gate electrode to a gate structure/gate dielectric is well known in the art as exemplified by Buchanan. It would be obvious to apply the gate structure of Buchanan to the gate dielectric of Rangarajan because one could apply the gate electrode to the gate dielectric with a reasonable expectation of success in forming a gate structure based on Buchanan's successful formation of a gate structure for a transistor. Furthermore, one intent of the gate dielectric is to protect the underlying silicon during processing (i.e. formation of the remainder of the gate structure).

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rangarajan (Thin Solid Films, 419, 2002, p1-4) as evidenced by Soulet (Optimizing,

Materials & Gases, Semiconductor Fabtech – 27th Edition) and Smith (7,070,833) in view of Buchanan (6,984,591), Kopacz (6,368,987) and Metzner (2003/0232506) as applied to claim 19 above and in further view of Johnson (WO02/075801).

The teachings of Rangarajan/etc are described above, teaching the formation of silicon oxide film but not by the exposure of the substrate to UV excited oxygen radicals.

Johnson teaches that the formation of a gate-quality oxide using UV radiation excited oxygen is known in the art (page 6, 2nd paragraph).

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the use of UV excited oxygen radicals to create a gate quality silicon oxide film for manufacture of a gate as the exposure of the silicon substrate to oxygen radicals it would allow one to react silicon with oxygen without a plasma discharge (Johnson, page 6).

Response to Arguments

Applicant's arguments filed 07/15/2009 have been fully considered but they are not persuasive.

Applicants have incorporated a number of limitations from previously dependent claims into independent claims. Applicants primary argument over the application of the prior art is that Rangarajan does not suggest a temperature for the HTB-Si2H6 reaction of the present invention. Examiner disagrees. The temperature used by Rangarajan is, as applicant notes, in the range of the substrate temperature of the present claims. One applying the method of Rangarajan in view of the other prior art would most obviously

apply the temperature taught by Rangarajan or one in that range if there were no motivation to try another temperature and/or as a starting point. The temperature used by Rangarajan *may* in fact fall into claimed range by "accident", but it would still be inherent that this temperature would meet the instant claimed temperature criteria. The MPEP teaches (2112: Requirements of Rejection Based on Inherency; Burden of Proof) that "The express, implicit, and inherent disclosures of a prior art reference may be relied upon in the rejection of claims under 35 U.S.C. 102 or 103. "The inherent teaching of a prior art reference, a question of fact, arises both in the context of anticipation and obviousness." In re Napier, 55 F.3d 610, 613, 34 USPQ2d 1782, 1784 (Fed. Cir. 1995) (affirmed a 35 U.S.C. 103 rejection based in part on inherent disclosure in one of the references). See also In re Grasselli, 713 F.2d 731, 739, 218 USPQ 769, 775 (Fed. Cir. 1983)."

The teaching of Smith of the use of a temperature that is "approximately equal to the gas's decomposition temperature" (col 3, lines 53-57) does not teach away from one applying the temperature of Rangarajan when modifying the invention by using disilane in lieu of silane.

Furthermore, the MPEP states that the optimization of ranges is obvious. See MPEP 2144.05 II. OPTIMIZATION OF RANGES, which states: "Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine

experimentation." While in the instant case, applicants assign a certain criticality to the temperature range, that range is taught in the prior art. The temperature would be an optimizable variable; one could determine the best temperature through routine experimentation.

So, in summary, it is examiner's position that because Rangarajan teaches a temperature of 410 degrees C, which is in instant claimed range, it would be obvious to use this temperature for a process wherein disilane is substituted for silane. Furthermore/in alternative, it would be obvious to optimize the temperature, using the temperature taught by Rangarajan at least as a starting point. The teachings of Smith do not teach a different range such as would make one of ordinary skill not apply the set point of Rangarajan.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOSEPH MILLER JR whose telephone number is (571)270-5825. The examiner can normally be reached on Mon-Thurs, 7am-4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JOSEPH MILLER JR/
Examiner, Art Unit 1792

/Bret Chen/
Primary Examiner, Art Unit 1792